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Transactions of the American Fisheries Society (1.314)

[Examining the 10-year rebuilding dilemma for U.S. fish stocks](#)

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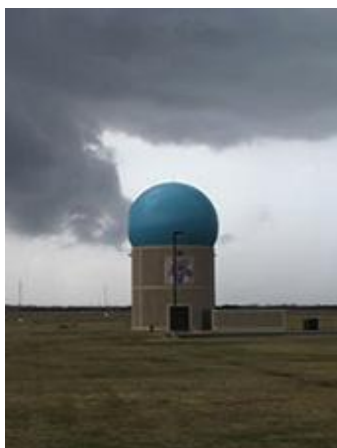
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OAR Publications

[A new method for instant correction of numerical weather prediction products in China](#)

Science China - Earth Sciences (1.340)

[Regionalization of hydrologic response in the Great Lakes basin: considerations of temporal scales of analysis](#)





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[Exploring the role of movement in determining the global distribution of marine biomass using a coupled hydrodynamic - size-based ecosystem model](#)

Progress in Oceanography (1.602)

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[Eliminating variation in age-at-spawning leads to genetic divergence within a single coho salmon population](#)

Journal of Fish and Wildlife Management (0.949)

[Variations in reproductive potential between nearshore and offshore spawning contingents of hogfish in the eastern Gulf of Mexico](#)

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Acta Veterinaria Scandinavica (1.38)





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[Genetic population structure of Willamette River steelhead and the influence of introduced stocks](#)

Transactions of the American Fisheries Society (1.31)

[Species associations and redundancy in relation to biological hotspots within the northern California Current ecosystem](#)

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HIGHLIGHTED ARTICLES

Coastal distribution and consequent factors influencing production of endangered Snake River sockeye salmon

Transactions of the American Fisheries Society (1.314)

S. Tucker, M. E. Thiess, J. F.T. Morris, D. L. Mackas, **B. T. Peterson**, J. R. Candy, T. D. Beacham, **E. Iwamoto**, **D. J. Teel**, and M. Trudel (NMFS/NWFSC)

- Following sea entry, Snake River sockeye salmon (*Oncorhynchus nerka*) smolts undertake a rapid northward migration bringing them well beyond the Columbia River estuary and plume and exposing them to ocean conditions prevailing off British Columbia.
- This analysis of Snake River sockeye salmon suggests that ocean conditions encountered in the first growing season in the marine environment, as indexed by copepod biomass anomalies, contribute to the variability in total adult returns.

Snake River sockeye salmon (*Oncorhynchus nerka*) were declared endangered in 1991 following several years of decreasing abundance. Several factors likely contributed to the decline of Snake River sockeye salmon, including poor marine survival. Little is known about their migration and ocean distribution and factors influencing their production. The author sampled coastal waters in June-July, October-November, and February-March from southern British Columbia to southeast Alaska 1998-2011 and in May-June and September from Oregon to Washington 2007-2010. A total of 8227 juvenile sockeye salmon were captured. Despite their extremely low abundance relative to other stocks, 15 coded-wire tagged juvenile Snake River sockeye salmon from Redfish Lake have been recovered primarily off the coast of British Columbia in spring and summer surveys since 2007. DNA analyses revealed an additional 8 juvenile Redfish Lake sockeye salmon also present in this area during summer. Snake River smolts undertook a rapid northward migration that brought them well beyond the Columbia





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River estuary and plume to expose them to ocean conditions prevailing off British Columbia. Through a multi-model inference approach, the Authors characterized associations between the number of returning adults and a suite of ocean and river variables. Seven ocean and five river variables were chosen for the model selection analysis including copepod anomalies, coastal upwelling, date of spring transition, river discharge, river temperature as well as the proportion of smolts transported through the hydrosystem. While adult return was highly correlated to smolt abundance, the authors' analyses suggest that ocean conditions encountered in the first growing season, as indexed by copepod biomass anomalies, contribute to the variability in total adult returns. There was also evidence for a negative effect of transporting smolts through the hydrosystem with the caveat of using transportation data for steelhead trout (*O. mykiss*) as a proxy.

Accepted: September 2014

Examining the 10-year rebuilding dilemma for U.S. fish stocks

PLoS One (3.534)

W. Patrick (NMFS/OSF) and J. Cope (NMFS/NWFSC)

- This article confirms and debunks several claims made by proponents and opponents regarding the effectiveness of U.S. fish stock rebuilding strategies.
- It demonstrates that alternative methods for calculating the maximum time allowed to rebuild (Tmax) may result in more consistent and simplified rebuilding strategies.
- The authors suggest re-purposing the current rebuilding framework as a “planning tool” that is more sensitive to environmental uncertainties (e.g., recruitment strength), rather than trying to force the stock to rebuild within a pre-specified timeframe.

Worldwide, fishery managers strive to maintain fish stocks at or above levels that produce maximum sustainable yields, and to rebuild overexploited stocks that can no longer support such yields. In the United States, rebuilding overexploited stocks is a contentious issue, where





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most stocks are mandated to rebuild in as short a time as possible, and in a time period not to exceed 10 years. Opponents of such mandates and related guidance argue that rebuilding requirements are arbitrary, and create discontinuities in the time and fishing effort allowed for stocks to rebuild due to differences in productivity. Proponents, however, highlight how these mandates and guidance were needed to curtail the continued overexploitation of these stocks by setting firm deadlines on rebuilding. Here we evaluate the statements made by opponents and proponents of the 10-year rebuilding mandate and related guidance to determine whether such points are technically accurate using a simple population dynamics model and a database of U.S. fish stocks to parameterize the model. We also offer solutions to many of the issues surrounding this mandate and its implementation by recommending fishing mortality based frameworks which meet the intent of the 10-year rebuilding requirement while also providing more flexibility.

Published online: 6 November 2014

<http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0112232>

Recent decade of growth and calcification of Orbicella faveolata in the Florida Keys: an inshore-offshore comparison

Marine Ecology Progress Series (2.64)

D. Manzello (OAR/AOML), I. Enochs, G. Kolodziej, and R. Carlton

- The fast growth and high resilience to thermal stress of inshore reefs is one of the reasons for why the inshore patch reefs of the Florida Keys have maintained high coral cover relative to the reefs offshore.

Coral reefs along the Florida Keys portion of the Florida Reef Tract (FRT) have undergone a dramatic decline since the 1980s. Since the 1997-98 El Niño event, coral cover on offshore reefs of the FRT has been $\leq 5\%$ and continued to decline. Mortality of the framework-constructing coral in the *Orbicella* (formerly *Montastraea*) *annularis* species complex has





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driven this recent loss in overall coral cover. One exception to this decline occurred on the inshore patch reefs of the Florida Keys, where coral cover has remained relatively high. We examined the growth and calcification of *Orbicella faveolata*, an ecologically important subspecies of the *O. annularis* complex, at both an inshore and offshore reef site representing this dichotomy of present-day coral cover. The period examined (2004-2013) encompasses the Caribbean-wide 2005 mass coral bleaching, the 2009-10 catastrophic cold-water bleaching, and a warm-water bleaching event in 2011. Extension and calcification rates were higher inshore every year from 2004-2013 except when there were thermal stress events that solely impacted inshore reefs (2009-10, 2011-12). Inshore growth rates recovered quickly from cold and warm-water stress. These higher calcification rates and their quick recovery after thermal stress are likely important factors in the persistence of high coral cover inshore.

Expected publication date: January 2015

Tornado warning decisions using phased array radar data

Weather and Forecasting (1.860)

P. Heinselman (OAR/NSSL), D. LaDue, D. M. Kingfield, and R. Hoffman

- This paper demonstrates positive impacts of rapid-scan phased array radar data on forecasters' tornado warning performance and decision making.
- Verification of the tornadic cases revealed that forecasters' use of PAR data provided a median tornado-warning lead time (TLT) of 20 min.
- Furthermore, polygon-based probability of detection ranged from 0.75–1.0 and probability of false alarm for all four cases ranged from 0.0–0.5.

The 2012 Phased Array Radar Innovative Sensing Experiment identified how rapidly scanned full-volumetric data captured known mesoscale processes and impacted tornado-warning lead time. Twelve forecasters from nine National Weather Service forecast offices used this rapid-scan phased array radar (PAR) data to issue tornado warnings on two low-end tornadic and two





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nontornadic supercell cases. Verification of the tornadic cases revealed that forecasters' use of PAR data provided a median tornado-warning lead time (TLT) of 20 min. Precursors that triggered forecasters' decisions to warn occurred within one or two typical WSR-88D scans, indicating PAR's temporal sampling better matches the time-scale at which these precursors evolve.

Early online release: 26 September 2014

Validating atmospheric reanalysis data using tropical cyclones as thermometers

Bulletin of the American Meteorological Society (11.57)

J. P. Kossin (NESDIS/NCDC)

- Satellite data from the region around tropical cyclones can be used to globally measure near-tropopause temperatures, which can then be used to mitigate uncertainties caused by disagreements among existing reanalysis products.
- Additionally, it is found that storm-local tropical cyclone potential intensity has not increased globally in the past 30 years.
- The results mitigate uncertainty in past changes in the tropical cyclone environment and are useful for detection and attribution of tropical cyclone activity changes in the past 30 years.

Temperatures in the upper-troposphere of the atmosphere, near the tropopause, play a key role in the evolution of tropical cyclones (TC) by controlling their potential intensity (PI), which describes the thermodynamically-based maximum TC intensity that the environment will support. Accurately identifying past trends in PI is critical for understanding the causes of observed changes in TC intensity, but calculations of PI trends using different atmospheric reanalysis products can give very different results, due largely to differences in their representation of upper-tropospheric temperatures. Without a means to verify the fidelity of the upper-tropospheric temperatures, PI trends calculated from these products are very uncertain.





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Here, a method is introduced to validate the upper-tropospheric temperatures in the reanalysis products by using the TCs themselves as thermometers. Using a 30-year global dataset of TC cloud-top temperatures, and three widely-utilized atmospheric reanalysis products – MERRA, ERA-Interim, and NCEP/NCAR – it is shown that storm-local upper-level temperatures in the MERRA and ERA-Interim data vary similarly to the TC cloud-top temperatures on both interannual and decadal timescales, but the NCEP/NCAR data have substantial biases that introduce an increasing trend in storm-local PI not found in the other two products. The lack of global storm-local PI trends is due to a balance between temporal increases in the mean state and the poleward migration of TCs into lower climatological PI, and has significant implications for the detection and attribution of mean TC intensity trends.

Acceptance date: 15 October 2014

ADDITIONAL ARTICLES

OAR Publications

A new method for instant correction of numerical weather prediction products in China
Science China - Earth Sciences (1.340)

L. Zhang, S. Wang, C. He, K. Shang, L. Meng, X. Li, and **B. M. Lofgren (OAR/GLERL)**

- The authors present a new method for improving the accuracy of short-range weather forecasts.
- This is an application for operational forecasting of weather in China that, because of its low cost, end users can benefit from.

This paper presents a new correction method, “instant correction method (ICM)”, to improve the accuracy of numerical prediction products (NPP) and provide weather variables at grid cells. The ICM makes use of the continuity in time of the forecast errors at different forecast times to improve the accuracy of large scale NPP. To apply the ICM in China, an ensemble correction scheme is designed to correct the most popular NPP in China (the T213 NPP) through different





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statistical methods. The corrected T213 NPP (ICM T213 NPP) are evaluated by four popular indices: Correlation coefficient, climate anomalies correlation coefficient, root-mean-square-errors (RMSE), and confidence intervals (CI). The results show that the corrected products are more accurate than the original T213 NPP in both the training period (2003–2008) and the validation period (2009–2010). Applications in China over the past three years indicate that the ICM is simple, fast, and reliable. Because of its low computing cost, end users in need of more accurate short-range weather forecasts around China can benefit greatly from the method.

Accepted: 11 June 2014

<http://link.springer.com/article/10.1007/s11430-014-4957-6>

Regionalization of hydrologic response in the Great Lakes basin: considerations of temporal scales of analysis

Journal of Hydrology (1.914)

J. Kult, L. Fry, **A. Gronewold (OAR/GLERL)**, and W. Choi

- Regionalization models were developed to predict runoff in ungaged watersheds in the Great Lakes basin.
- Predictions in ungaged watersheds are highly influenced by the temporal scale used to condition the models.

Methods for predicting streamflow in areas with limited or nonexistent measures of hydrologic response commonly rely on regionalization techniques, where knowledge pertaining to gaged watersheds is transferred to ungaged watersheds. Hydrologic response indices have frequently been employed in contemporary regionalization research related to predictions in ungaged basins. In this study, we developed regionalization models using multiple linear regression and regression tree analysis to derive relationships between hydrologic response and watershed physical characteristics for 163 watersheds in the Great Lakes basin. These models provide a means for predicting runoff in ungaged basins at a monthly time step without implementation of





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any process-based rainfall-runoff model. Major findings from the study include (1) Monthly runoff in ungaged watersheds were predicted with reasonable skill using regression models between runoff ratio and watershed physical characteristics; (2) Regression tree models produced outcomes comparable to a linear regression model; (3) Predictions in ungaged watersheds were highly influenced by the temporal scale used to condition the regression models. These results indicate that predictions based on long-term characterizations of hydrologic response can produce misleading conclusions when applied at shorter time steps. It is argued that different temporal characterizations of hydrologic response relate to different water resource research and management objectives.

Publication date (online): October 2014

DOI: 10.1016/j.jhydrol.2014.09.083

Exploring the role of movement in determining the global distribution of marine biomass using a coupled hydrodynamic - size-based ecosystem model

Progress in Oceanography (1.602)

J. R. Watson, **C. A. Stock (OAR/GFDL)**, and J. L. Sarmiento

- The abundance and distribution of fish biomass in the ocean is estimated by coupling a size-based fish food web model to retrospective ocean physics and biogeochemistry simulations covering the past 60 years.
- Integrating fisheries food web dynamics into GFDL's Earth System Models and uncovering the role of movement in shaping large-scale fish distributions are key steps in developing a large-scale predictive capacity for fish.

Modeling the dynamics of marine populations at a global scale – from phytoplankton to fish – is necessary if we are to quantify how climate change and other broad-scale anthropogenic actions affect the supply of marine-based food. Here, we estimate the abundance and distribution of fish biomass using a simple size-based food web model coupled to simulations of global ocean





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physics and biogeochemistry. We focus on the spatial distribution of biomass, identifying highly productive regions – shelf seas, western boundary currents and major upwelling zones. In the absence of fishing, we estimate the total ocean fish biomass to be $\sim 2.84 \times 10^9$ tonnes, similar to previous estimates. However, this value is sensitive to the choice of parameters, and further, allowing fish to move had a profound impact on the spatial distribution of fish biomass and the structure of marine communities. In particular, when movement is implemented the viable range of large predators is greatly increased, and stunted biomass spectra characterizing large ocean regions in simulations without movement, are replaced with expanded spectra that include large predators. These results highlight the importance of considering movement in global-scale ecological models.

Publication date (online): September 2014

<http://dx.doi.org/10.1016/j.pocean.2014.09.001>

NMFS Publications

Crossing to safety: dispersal, colonization and mate choice in evolutionarily distinct populations of Steller sea lions, Eumetopias jubatus

Molecular Ecology (5.84)

G. O’Corry-Crowe, **T. Gelatt** (NMFS/AKFSC), L. Rea, **C. Bonin** (NMFS/SWFSC), and M. Rehberg

- This study indicates that despite population decline in the western stock of Steller sea lions (*Eumetopias jubatus*), animals may still move from a decreasing population into an increasing population.
- Steller sea lions from two distinct stocks that have been recognized as different subspecies can and do interbreed near the stock boundary.
- The evidence for this phenomenon has only been documented to have occurred during the last 15 or so years.





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Population growth typically involves range expansion and establishment of new breeding sites, while the opposite occurs during declines. Although density dependence is widely invoked in theoretical studies of emigration and colonization in expanding populations, few empirical studies have documented the mechanisms. Still fewer have documented the direction and mechanisms of individual transfer in declining populations. Here, the authors screened large numbers of pups sampled on their natal rookeries for variation in mtDNA ($n = 1106$) and 16 microsatellite loci ($n = 588$) and showed that new Steller sea lion breeding sites did not follow the typical paradigm and were instead colonized by sea lions from both a declining (Endangered) population and an increasing population. Dispersing individuals colonized rookeries in the distributional hiatus between two evolutionarily distinct ($U_{st} = 0.053$, $K = 2$) metapopulations recently described as separate subspecies. Hardy–Weinberg, mixed-stock and relatedness analysis revealed levels of interbreeding on the new rookeries that exclude (i) assortative mating among eastern and western forms, and (ii) inbreeding avoidance as primary motivations for dispersal. Positive and negative density dependence is implicated in both cases of individual transfer. Migration distance limits, and conspecific attraction and performance likely influenced the sequence of rookery colonizations. This study demonstrates that resource limitation may trigger an exodus of breeding animals from declining populations, with substantial impacts on distribution and patterns of genetic variation. It also revealed that this event is rare because colonists dispersed across an evolutionary boundary, suggesting that the causative factors behind recent declines are unusual or of larger magnitude than normally occur.

Accepted: 10 September 2014

<http://onlinelibrary.wiley.com/doi/10.1111/mec.12944/abstract>

Eliminating variation in age-at-spawning leads to genetic divergence within a single coho salmon population

Journal of Fish and Wildlife Management (0.949)





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C. T. Smith, J. Baumsteiger, W. R. Ardren, Y. Defflaff, D. K. Hawkins, and **D. M. Van Doornik (NMFS/NWFSC)**

- This study analyzed 10 microsatellite loci across collections of coho salmon (*Oncorhynchus kisutch*) from Quilcene National Fish Hatchery and adjacent wild and hatchery populations to evaluate divergence among the three broodlines and assess the relationship between return time, genetic divergence and genetic diversity.
- The exclusion of precocious males resulted in three genetically distinct broodlines, which exhibited levels of divergence greater than those typical among coho salmon populations.
- These results demonstrate the importance of precocious males in shaping the population genetic structure of coho salmon.

Most coho salmon (*Oncorhynchus kisutch*) in Washington State spawn at three years of age, creating the potential for three separate temporal populations or “broodlines” at each spawning site. This is generally prevented by a portion of males in each population which mature and spawn as two-year olds, providing gene flow among the three year classes. Quilcene National Fish Hatchery (NFH) selected against late run timing by excluding all but the earliest returning fish for the broodstock for an unknown number of generations and excluded two-year old males from its broodstock for 27 generations. The resulting hatchery population exhibited three phenotypically distinct broodlines which would return in alternating years: an “early” broodline which arrived one month before the wild fish; a “late” broodline which arrived at the same time as the wild fish; and a “middle” return year which arrived in between these two. Over the past six generations, two-year old males have been reintroduced in an effort to fuse these three broodlines. The authors analyzed 10 microsatellite loci across collections of coho salmon from Quilcene NFH and adjacent wild and hatchery populations to evaluate divergence among the three broodlines and assess the relationship between return time, genetic divergence and genetic diversity. These results indicated that exclusion of precocious males resulted in three genetically distinct broodlines, which exhibited levels of divergence greater than those typical among coho





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salmon populations. The Authors also observed that the “early” broodline was the most genetically divergent from wild populations and held the least genetic diversity. Finally, the authors observed that the recent incorporation of jacks and concomitant breakdown of the run time structure has been accompanied by a reduction in genetic divergence among broodlines. These results demonstrate the importance of precocious males in shaping the population genetic structure of coho salmon.

Expected publication date: Fall 2014

Variations in reproductive potential between nearshore and offshore spawning contingents of hogfish in the eastern Gulf of Mexico

Fisheries Management and Ecology (1.136)

A. B. Collins and **R. S. McBride (NMFS/NEFSC)**

- The study investigate the effect of spatial variation on hogfish (*Lachnolaimus maximus*) reproductive potential using an indetermined egg production model.
- There is spatial variation in reproductive traits within a single stock, and these variations are associated with spatial variations in size and age within the same stock.
- This variation is likely to account for the relative stability of this population, but if fishing methods change, then management should account for these spatial variations in phenotypes in its response.

Hogfish, *Lachnolaimus maximus* (Walbaum), have multiple traits that confound measuring reproductive potential: they are protogynous, relatively long-lived harem-forming fish that spawn daily for months. Additionally, recent evidence demonstrates that size, age and timing of sex change vary on a spatial scale within the study area (West Florida shelf, USA). This study investigate the effect of this spatial variation on hogfish reproductive potential by evaluating spawning seasonality, spawning frequency and batch fecundity using an indeterminate egg production model. Offshore females were larger than nearshore females, and batch fecundity





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was related in a log-linear manner to female size. Gonad histology demonstrated a more protracted reproductive period for females offshore (8 months) than nearshore (4 months). Spatial variations in size coincide with ontogeny because hogfish move offshore with growth; however, even after accounting for fish size, offshore females spawned more. In areas where male removal rates are elevated, spawning harems are disrupted; thus, greater fishing effort nearshore may further reduce the reproductive potential of these females. These nearshore and offshore spawning components of the population are not genetically distinct, but instead represent two contingent spawning strategies that likely enhance total population stability and resilience of this stock in the eastern Gulf of Mexico.

Expected publication date: November 2014

Contemporary population structure and post-glacial genetic demography in a migratory marine species, the blacknose shark, Carcharhinus acronotus

Molecular Ecology (5.84)

D. S. Portnoy, C. M. Hollenbeck, C. N. Belcher, **W. B. Driggers III** (NMFS/SEFSC), B. S. Brazier, J. Gelsleichter, R. D. Grubbes, J. R. Gold

- The authors' work demonstrates that there are five genetic populations of blacknose sharks in the western North Atlantic Ocean.
- The results from this study suggest that blacknose sharks may need to be managed as three stocks within US waters.

Patterns of population structure and historical genetic demography of blacknose sharks in the western North Atlantic Ocean were assessed using variation in nuclear-encoded microsatellites and sequences of mitochondrial (mt)DNA. Significant heterogeneity and/or inferred barriers to gene flow, based on microsatellites and/or mtDNA, revealed the occurrence of five genetic populations localized to five geographic regions: the southeastern U.S Atlantic coast, the eastern Gulf of Mexico, the western Gulf of Mexico, Bay of Campeche in the southern Gulf of





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Mexico and the Bahamas. Pairwise estimates of genetic divergence between sharks in the Bahamas and those in all other localities were more than an order of magnitude higher than between pairwise comparisons involving the other localities. Demographic modelling indicated that sharks in all five regions diverged after the last glacial maximum and, except for the Bahamas, experienced post-glacial, population expansion. The patterns of genetic variation also suggest that the southern Gulf of Mexico may have served as a glacial refuge and source for the expansion. Results of the study demonstrate that barriers to gene flow and historical genetic demography contributed to contemporary patterns of population structure in a coastal migratory species living in an otherwise continuous marine habitat. The results also indicate that for many marine species, failure to properly characterize barriers in terms of levels of contemporary gene flow could in part be due to inferences based solely on equilibrium assumptions. This could lead to erroneous conclusions regarding levels of connectivity in species of conservation concern.

Expected publication date: Fall 2014

Prevalence of Coxiella burnetii and Brucella spp. in tissues from subsistence harvested northern fur seals (Callorhinus ursinus) of St. Paul Island, Alaska

Acta Veterinaria Scandinavica (1.38)

C. G. Duncan, **B. Dickerson**, K. Pabilonia, and **T. Gelatt** (NMFS/AKFSC)

- Results of this study suggest that the risk of exposure to *C. burnetii* and *Brucella* spp. through subsistence harvesting of male NFS on St. Paul Island is extremely low; only 0.25% of tested samples (one animal) had evidence of bacterial DNA in tested tissues.
- Because this is a declining population and *Brucella* is known to have detrimental effects on herd animals, this knowledge is useful for future research investigating potential reasons for the decline.





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- *Brucella* is a zoonotic disease and the animals tested were killed for human consumption. This information is useful to state health agencies.

The northern fur seal (*Callorhinus ursinus*) is an important cultural and nutritional resource for the Aleut community on St. Paul Island Alaska. In recent years, an increasing number of zoonotic pathogens have been identified in the population, but the public health significance of these findings is unknown. To determine the prevalence of *Coxiella burnetii* and *Brucella* spp. in northern fur seal tissues, eight tissue types from 50 subsistence-harvested fur seals were tested for bacterial DNA by real-time polymerase chain reaction. Of the 400 samples tested, only a single splenic sample was positive for *Brucella* spp. and the cycle threshold (ct) value was extremely high suggesting a low concentration of DNA within the tissue. *C. burnetii* DNA was not detected. Findings suggest that the risk of humans contracting brucellosis or Q fever from the consumption of harvested northern fur seals is low.

Publication date: 1 October 2014

Genetic population structure of Willamette River steelhead and the influence of introduced stocks

Transactions of the American Fisheries Society (1.31)

D. M. Van Doornik, M. A. Hess, M. A. Johnson, **D. J. Teel**, T. A. Friesen, **J. M. Myers** (NMFS/NWFSC)

- Introduced early winter-run steelhead appear to be the origin of steelhead inhabiting certain Willamette River tributaries where native steelhead did not historically spawn. Conservation genetics studies are frequently conducted on Pacific salmon (*Oncorhynchus* sp.) to delineate their population structure and to quantify their genetic diversity, especially for populations that have experienced declines in their abundance and are subject to anthropomorphic activities. One such group of salmonids is steelhead (*O. mykiss*) from the Willamette River, a tributary of the Columbia River. Within the Willamette River there are





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multiple steelhead life history and run timing types, some of which originated from non-native populations. Late winter-run steelhead and rainbow trout (the freshwater resident type of *O. mykiss*) are native to the Willamette River, whereas early winter-run and summer-run steelhead have been introduced into the system via releases from artificial propagation efforts. We conducted genetic analyses of Willamette River steelhead to determine their genetic population structure with regard to the effect that non-native steelhead released into the Willamette River basin have had on the native steelhead. We found genetic differentiation among the samples that separated them into four population groupings that corresponded to run type. Possibly due to local adaptation, the native run type has retained its genetic distinctiveness from the introduced types, despite there being opportunities for gene flow among them. Introduced early winter-run steelhead appear to be the origin of steelhead inhabiting certain Willamette River tributaries where native steelhead did not historically spawn.

Acceptance date: 23 October 2014

Species associations and redundancy in relation to biological hotspots within the northern California Current ecosystem

Journal of Marine Systems (2.476)

D. C. Reese, **R. D. Brodeur** (NMFS/NWFSC)

- Biological hotspots in this highly dynamic system may persist due to species redundancy, which is an important attribute contributing to stability in the California Current ecosystem.
- The authors investigated species associations in hotspots, and found strong negative and positive associations.
- Dominant species varied seasonally and annually, although similar functional groups and habitat preferences in dominant species support the idea that species redundancy contributes to the maintenance of these hotspots.





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The dynamic nature of biological hotspots, while well recognized, is not well understood. We hypothesize that the persistence of hot-spots in the northern California Current System (CCS), despite seasonal and annual changes in the nekton community species composition, is related to associations among species and their functional redundancy. To address this hypothesis, sampling was conducted during June and August of 2000 and 2002 within two hot-spots occurring between Newport, Oregon and Crescent City, California in the coastal CCS.

Associations were examined to identify potentially complementary and redundant species. The strongest negative associations were between jellyfish and fish species, with strong positive associations evident among several fish species. Dominant species varied seasonally and annually, although evidence indicated replacement of dominant species by other similar species with respect to functional group and preferred habitat. This finding suggests that the persistence of these biological hotspots is related to species redundancy and is an important attribute contributing to stability within this highly variable system.

Acceptance date: 18 September 2014

<http://www.sciencedirect.com/science/article/pii/S0924796314002474>

When to be discrete: the importance of time formulation in understanding animal movement
Movement Ecology

B. McClintock, D. Johnson, M. B. Hooten, J. Ver Hoef, and J. M. Morales (NMFS/AKFSC)

- The authors explore the differences and similarities between continuous and discrete versions of mechanistic movement models, establish some common terminology, and indicate under which circumstances one form might be preferred over another.
- Counter to the overly simplistic view that discrete- and continuous-time conceptualizations are merely different means to the same end, we reveal hitherto unappreciated consequences of model formulation on inferences about animal movement.





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Animal movement is essential to our understanding of population dynamics, animal behavior, and the impacts of global change. Coupled with high-resolution biotelemetry data, exciting new inferences about animal movement have been facilitated by various specifications of contemporary models. These approaches differ, but most share common themes. One key distinction is whether the underlying movement process is conceptualized in discrete or continuous time. This is perhaps the greatest source of confusion among practitioners, both in terms of implementation and biological interpretation. In general, animal movement occurs in continuous time but we observe it at fixed discrete-time intervals. Thus, continuous time is conceptually and theoretically appealing, but in practice it is perhaps more intuitive to interpret movement in discrete intervals. With an emphasis on state-space models, we explore the differences and similarities between continuous and discrete versions of mechanistic movement models, establish some common terminology, and indicate under which circumstances one form might be preferred over another. Counter to the overly simplistic view that discrete- and continuous-time conceptualizations are merely different means to the same end, we present novel mathematical results revealing hitherto unappreciated consequences of model formulation on inferences about animal movement. Notably, the speed and direction of movement are intrinsically linked in current continuous-time random walk formulations, and this can have important implications when interpreting animal behavior. We illustrate these concepts in the context of state-space models with multiple movement behavior states using northern fur seal (*Callorhinus ursinus*) biotelemetry data.

Publication date: 15 October 2014

http://download.springer.com/static/pdf/981/art%253A10.1186%252Fs40462-014-0021-6.pdf?auth66=1415402839_4770e25c854281971859a22b7acbaa5d&ext=.pdf





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Lack of variation in voltage-gated sodium channel genes of common bottlenose dolphins (Tursiops truncatus) exposed to neurotoxic algal blooms

Aquatic Toxicology (1.491)

K. M. Cammen, **P. E. Rosel** (NMFS/SEFSC), R. S. Wells, and A. J. Read

- No correlation was found between genetic variation in voltage-gated sodium channel genes and common bottlenose dolphin survival after exposure to brevetoxin from harmful algal blooms (HABs).
- The results suggest bottlenose dolphins have not evolved resistance to HABs via mutations in genes encoding the brevetoxin binding site on the voltage-gated sodium channels.

In coastal marine ecosystems, neurotoxins produced by harmful algal blooms (HABs) often result in large-scale mortality events of many marine species. Historical and frequent exposure to HABs therefore may provide a strong selective pressure for adaptations that result in toxin resistance. Neurotoxin resistance has independently evolved in a variety of terrestrial and marine species via mutations in genes encoding the toxin binding sites within the voltage-gated sodium channel gene complex. Accordingly, we tested the hypothesis that genetic variation in the putative binding site of brevetoxins in common bottlenose dolphins (*Tursiops truncatus*) explains differences among individuals or populations in resistance to harmful *Karenia brevis* blooms in the Gulf of Mexico. We found very little variation in the sodium channel exons encoding the putative brevetoxin binding site among bottlenose dolphins from central-west Florida and the Florida Panhandle. Our study included samples from several bottlenose dolphin mortality events associated with HABs, but we found no association between genetic variation and survival. We observed a significant effect of geographic region on genetic variation for some sodium channel isoforms, but this can be primarily explained by rare private alleles and is more likely a reflection of regional genetic differentiation than the cause of different levels of HAB resistance between regions. In contrast to many other previously studied neurotoxin-





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resistant species, we conclude that bottlenose dolphins have not evolved resistance to HABs via mutations in genes encoding the brevetoxin binding site on the voltage-gated sodium channels.

Acceptance date: 14 October 2014

Environmental conditions and habitat characteristics influence trap and video detection probabilities for reef fish species

Marine Ecology Progress Series (2.64)

N. Bacheler, D. Berrane, W. Mitchell, C. Schobernd, Z. Schobernd, B. Teer, J. Ballenger (SEFSC-Beaufort)

- This approach can be considered an alternative to occupancy modeling when sample sizes are limited and the primary interest is to estimate detection probability, not occupancy rates.
- The paper recommends adding video cameras to other commonly used sampling gears such as trawls, acoustics, or nets if researchers are interested in understanding how detection probabilities of each gear are influenced by various environmental predictor variables.
- Knowing how environmental predictor variables influence the sampling process of various gears and gear-specific detection probabilities can help scientists design optimal surveys, especially for rare or elusive species.

Monitoring programs often collect presence-absence data that can be used to understand range expansions or contractions, metapopulation dynamics, alien species invasions, or spatio-temporal trends in relative abundance. Using the proportion of sites occupied by a species can be misleading, however, if surveys routinely fail to detect species that are present at a site. The authors used chevron traps paired with underwater videos ($N = 1,555$) in a binomial (presence-absence) generalized additive modeling framework to quantify how environmental conditions, habitat characteristics, and site abundance influenced the detection probabilities of a variety of





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economically important reef fish species in the southeastern United States. After accounting for variable site abundance, trap detection probabilities declined 40% for red porgy *Pagrus pagrus*, 65% for gray triggerfish *Balistes capriscus*, and 75% for vermilion snapper *Rhomboplites aurorubens* as percent hard bottom increased from 0 to 100%. Increasing water temperature caused red porgy trap detection probability to decline modestly, while for gray triggerfish and vermilion snapper it increased substantially. Underwater video was more likely to detect black sea bass *Centropristis striata*, red porgy, and gray triggerfish when site abundance and water clarity were high and the video camera was facing down-current. These results underscore the importance of dealing with imperfect detectability, especially in a dynamic coastal ecosystem like the southeastern United States. This approach can be considered an alternative to occupancy modeling when sample sizes are limited and the primary interest is to estimate detection probability, not occupancy rates.

Expected publication date: Winter

Pelagic and demersal fish predators on juvenile and adult forage fishes in the Northern California Current: spatial and temporal variations

California Cooperative Oceanic Fisheries Investigations Reports (1.1)

R. D. Brodeur, J. C. Buchanan, and R. L. Emmett (NMFS/NWFSC)

- This paper reviews the dominant fish and elasmobranch predators of forage fishes off Washington, Oregon and Northern California and found substantial seasonal, interannual and geographic variations and identified the important overall predators.
- Predation on forage fishes was highly variable in space and time, and was often dependent on the size of the prey available as well as the predator.

A requisite for reliable food web models and ecosystem-based management in regions such as the California Current is the availability of diet information on key predators. In ecosystems designated as wasp-waist systems believed to be the situation in most upwelling ecosystems,





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much of the lower trophic level energy is transferred through a relatively small set of very abundant pelagic forage fish taxa, such as anchovies, sardines, smelts, and herring. In addition, the pelagic juvenile stages of some important midwater and demersal fishes (Pacific hake and rockfishes) may act as forage fishes during a more limited time period each year. This paper reviews what is known about the utilization of these forage species by larger fish predators and elasmobranchs in the Northern California Current (NCC) from northern Washington to northern California (Cape Mendocino) to examine spatial and temporal variations in the kinds and sizes of forage fishes consumed. The authors found that predation on forage fishes was highly variable in space and time, and was often dependent on the size of the prey available as well as the predator. Pacific hake and spiny dogfish have the potential to be dominant forage fish predators due to their high biomass but other species such as arrowtooth flounder and Pacific halibut can be important due to their high proportion of forage fish in the diet. This paper also highlights where diet information is poor or lacking, and areas where regular fish diet monitoring could be useful for ecosystem-based management.

Expected publication date: December 2014

*Fish trophic engineering: ecological effects of the invasive ascidian *Didemnum vexillum* (Georges Bank, northwestern Atlantic)*

Journal of Experimental Marine Biology and Ecology (2.47)

B. E. Smith (NMFS/NEFSC), J. Collie, and N. Lengyel

- *Didemnum vexillum* significantly altered the prey compositions of the five fishes examined, and fish trophic diversity was generally higher in areas where *D. vexillum* was present.
- Prey responsible for site differences were benthos correlated with *D. vexillum*.
- Differences in the total amount of food eaten per individual fish were minimal between contrasting sites.





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In the northwest Atlantic, concerns for the benthic communities of Georges Bank have evolved following the widespread detection of the invasive ascidian *Didemnum vexillum* in 2002. One question is whether *D. vexillum* affects the feeding of fishes, particularly commercially-important species. The major objectives of this study were to examine the diets of five demersal fishes and the benthic epifauna (prey field) across contrasting levels of *D. vexillum* occurrence from 2004 to 2008 in and around northern Closed Area II of Georges Bank (42.0°N, 67.3°W). The fishes examined were winter skate (*Leucoraja ocellata*), little skate (*L. erinacea*), haddock (*Melanogrammus aeglefinus*), winter flounder (*Pseudopleuronectes americanus*), and longhorn sculpin (*Myoxocephalus octodecemspinosus*). Cumulative fish trophic diversity was often higher at sites where *D. vexillum* was present as measured by Shannon's H' . Diets were significantly different across levels of *D. vexillum* for the five fishes, and feeding by haddock was positively correlated with the benthic epifauna within rather than across sites, indicating site-specific feeding. For many fishes, prey that contributed to the diet dissimilarity between sites were benthic epifauna strongly associated with the presence of *D. vexillum* (Class Polychaeta: *Nereis zonata*, *Harmothoe extenuata*, and *Lepidonotus squamatus*; and Order Decapoda: *Cancer irroratus*) and absence of *D. vexillum* (Order Decapoda: *Crangon septemspinosa*). These feeding alterations are not necessarily negative, as fish diets in this region regularly contain prey positively associated with *D. vexillum*. However, with the momentum to incorporate habitat science into fish stock assessments, managers should not consider protected fish habitat to be static in the presence of habitat modifiers such as invasive ascidians. From influencing the trophic ecology of demersal fishes to driving substrate homogeneity, long-term monitoring and invasive ascidian management for this continental shelf region is recommended.

Acceptance date: September 2014

Alewife populations at risk with population declines of energy-rich zooplankton in dreissenid-invaded Lake Michigan





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Environmental Biology of Fishes (1.356)

S. Pothoven, G. Fahnenstiel (OAR/GLERL)

- The article characterizes how the recent decline in the energy content of yearling alewife can be linked to recent changes in productivity and abundance of key zooplankton species in the Lake Michigan food-web.
- Results from this research raises concern that the alewives' lower energy content observed from 2010-2013 could lead to their high overwinter/spring mortality resulting from starvation or by increased vulnerability to predation. Since the alewife is an important component in the salmonid diet, the reduced energy content of alewife could cause population declines for salmonids and other species of predatory/sport fish, creating further challenges for effective management.

The focus of this research is on the non-native fish alewife (*Alosa pseudoharengus*), which is a dominant planktivore (consumer of zooplankton and phytoplankton) and a key component of the ecosystem in Lake Michigan. Juvenile alewife were collected in Lake Michigan in the vicinity of Muskegon in 1998, 1999, 2010, 2011, 2013 to evaluate changes in the fishes' energy content. As part of a long-term NOAA GLERL research project in the area, water temperature was recorded at 110 m deep site off Muskegon each month from March/April through November/December. To provide an index of prey abundance for the alewife, data on zooplankton density were used from a 45 m and 110 m site in the area that been collected as part of the long-term research program. In comparing the energy content of age-0 alewife from 1998-1999 and 2010-2013, it was found that the overwinter energy losses in this forage fish were more severe for the 2010 year class than that of 1998. Results comparing zooplankton densities between those same timeframes indicate that the zooplankton densities in 1998-1999 were higher than in 2010-2013. When examining the alewife's diet in 1998 and 1999, energy rich zooplankton were consumed, namely, *Diporeia* spp. along with *Mysis diluviana* or copepods. In 2010, the quality of alewife diet declined to lower energy prey including





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chironomids and copepod zooplankton. The absence of *Diporeia* in the alewife diet in 2010 is related to the disappearance of *Diopetia* in Lake Michigan that occurred in coincidence with the invasion of dreissenid mussels. Overall, results from this research raise concern that the alewives' lower energy content observed from 2010-2013 could lead to their high overwinter/spring mortality resulting from starvation or by increased vulnerability to predation. Since the alewife is an important component in the salmonid diet, the reduced energy content of alewife could cause population declines for salmonids and other predatory/sport fish. The decline of forage fish, such as the alewife, could pose significant challenges to managers in their efforts to maintain healthy populations of stocked salmonids in the dreissenid-invaded Great Lakes.

Expected publication date: Fall 2014

Building on fisheries acoustics for marine ecosystem surveys

Oceanography (2.986)

J. P. Zwolinski, D. A. Demer, G. R. Cutter Jr., K. Stierhoff, and B. J. Macewicz
(NMFS/SWFSC)

- Authors suggest that the data necessary to manage Coastal Pelagic Species with an ecosystem perspective may be obtained from frequent multi-species surveys of and their biotic and abiotic environment.
- They rely on surveys based on a combination of acoustic and trawl sampling, coupled with complementary measures from numerous other sensors.
- They underscore the value of acoustic and trawl sampling.

NOAA Fisheries endeavors to manage fish stocks with an ecosystem perspective. This objective requires an understanding of the effects of the environment and fishing on all major components of ecosystem. For example, in large upwelling systems like the California Current Ecosystem (CCE), natural cycles in the oceanographic and atmospheric conditions appear to





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drive large fluctuations in the distributions and relative abundances of coastal pelagic fish species (CPS), for example sardine, anchovy, mackerel, and herring. These changes may be accelerated or delayed, by mortality due to fishing and predation by larger fish, marine mammals, and seabirds. We suggest that the data necessary to manage CPS with an ecosystem perspective may be obtained from frequent surveys of multiple CPS and their biotic and abiotic environment. We show that this is practical with surveys based on a combination of acoustic and trawl sampling, coupled with complementary measures from numerous other sensors. Such acoustic-trawl-method (ATM) surveys of the CCE were conducted during the spring and summer of 2012 and 2013. We present the results of these surveys including the seasonal distributions and abundances of multiple of the most ecological and economically important CPS. These data hint at the ultimate potential of periodic surveys using ATM sampling augmented with physical oceanographic, zooplankton, ichthyoplankton, fish, seabird, and mammal investigations to characterize the ecosystem. The 2 results from future surveys will expand further to include the distributions, abundances, and perhaps potential habitats of other CPS, euphausiids, and gelatinous organisms, as well as concurrent underway measures of physical ceanography, ichthyoplankton and phytoplankton, highly-migratory fishes, seabirds and marine mammals.

Expected publication date: December 2014

A novel approach to compare pinniped populations across a broad geographic range

Canadian Journal of Fisheries and Aquatic Sciences

K. L. Sweeney (NMFS/AKFSC), K. W. Shertzer, L. W. Fritz (NMFS/AKFSC), and A. J. Read

- Study explores pinniped populations using unique approach through aerial images and photogrammetric methodologies in Alaska.





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- Adult sea lions were significantly shorter in the eastern than western distinct population segment in Alaskas supporting NMFS' designation of the two stocks.
- Finite mixture models using length frequency distributions from regions with different trends can provide information on how populations are responding (e.g., which vital rate, survival or reproduction, is changing?), particularly for populations with no longitudinal studies of marked animals to support management decisions.

We utilized aerial images and employed photogrammetric methodologies to collect standardized lengths of Steller sea lions terrestrially hauled out. We conducted comparisons among all site-types, and separately for rookery and haulout site-types between the two distinct population segments (DPSs; eastern and western) and two broad regions within the western DPS experiencing contrasting population abundance trends. An observed adult female index was created from measurements of reproductive females—in the presence of a pup or juvenile—and was applied as a model constraint for 'adult females.' We fitted a finite mixture distribution model to the length-frequency data to estimate the proportion population for three delineated age-sex classes (juveniles, adult females, and adult males) and mean length for juveniles and adult males. Estimated proportions reflected what we expected however, the broad region within the western DPS exhibiting significant population declines had greater proportion of all age-sex classes on rookery sites than increasing broad region. Adult sea lions were significantly shorter in the eastern DPS than the western providing further evidence of morphological differences between the DPSs. Findings support NMFS' designation of the two stocks. We also introduce a less resource demanding method for estimating population demographics, and potentially vital rates, for pinnipeds across a vast geographic range. Finite mixture models using length frequency distributions from regions with different trends can provide information on how populations are responding (e.g., which vital rate, survival or reproduction, is changing?), particularly for populations with no longitudinal studies of marked animals





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<http://www.nrcresearchpress.com/doi/abs/10.1139/cjfas-2014-0070#.VEhEmPl4pcQ>

NESDIS Publications

A Holocene East Asian winter monsoon record at the southern edge of the Gobi Desert and its comparison with a transient simulation

Climate Dynamics (4.619)

Y. Li, C. Morrill (NESDIS/NCDC)

- Both a new dust record from the Gobi Desert and output from a coupled climate model simulation demonstrate that the East Asian Winter Monsoon has declined in strength over the last 12,000 years.
- The model simulation further explains that this trend derives from changes in the Earth's orbit and their effects on surface temperature. These conclusions are important because there has been disagreement in the scientific community on whether the winter monsoon has become stronger or weaker through time.
- The East Asian Winter Monsoon is a major center of activity for global winter circulation and even has downstream effects on North American weather. This research indicates that the contrast between land and ocean temperatures has controlled the strength of the winter monsoon.

The East Asian winter monsoon (EAWM) exhibits significant variability on intraseasonal, interannual, and interdecadal time scales and the variability can be extended to Holocene centennial and millennial scales. Previous Holocene EAWM proxy data records, which were mostly located in Central, Eastern and Southern China, did not show a consistent Holocene EAWM history. Therefore, it is difficult to provide insights into mechanisms of the long-term winter monsoon variability on the basis of the records. Eolian sediments at the southern edge of the Gobi Desert, western China, are sensitive to the EAWM changes and less affected by the East Asian summer monsoon (EASM) due to an obstruction of the Qinghai-Tibet Plateau. This paper presents a comparison between a well-dated Holocene EAWM record and coupled





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climate model simulations, so as to explore physical processes and influencing factors of the Holocene EAWM. Sediment samples from two Holocene eolian sedimentary sections (Huangyanghe(a) and Huangyanghe(b)) were acquired at the southern edge of the Gobi Desert. Chronologies were established based on twenty bulk organic matter AMS ^{14}C ages and five pollen concentrates AMS ^{14}C ages. Proxy data, including grain-size, total organic carbon (TOC), magnetic susceptibility (MS) and carbonate content (CC) were obtained from the two eolian sections. The grain-size standard deviation model was applied to determine components sensitive to variability of the Holocene EAWM. After a comparison of environmentally-sensitive grain-size components and proxy data, the 20-200 μm component at the Huangyanghe (a) and the 20-159 μm component at the Huangyanghe (b) section were selected as indicators of the Holocene EAWM, which show a strong early Holocene winter monsoon and a decline of the winter monsoon since the mid-Holocene. We also present equilibrium and transient simulations of the climate evolution for the Holocene using a state-of-art coupled climate model: the Community Climate System Model version 3 (CCSM3). Indices for the Holocene EAWM were calculated and are consistent with the reconstructed Holocene EAWM intensity. The simulations indicate that orbital forcing effects on the land-sea temperature and sea level pressure contrast can account for the observed EAWM trends. Other forcings that were present in the early Holocene, including the remnant Laurentide ice sheet and meltwater forcing in the North Atlantic, were not responsible for the Holocene trends.

Publication date: 21 October 2014

<http://link.springer.com/article/10.1007/s00382-014-2372-5>

OTHER REPORTS, BOOK CHAPTERS, AND INTERNAL PUBLICATIONS

NOS/NCCOS

Marine protected areas of the U.S. Virgin Islands: ecological progress report

NOAA Tech Memo 187





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S. J. Pittman, L. Bauer, S. D. Hile, C. F. G. Jeffrey, and E. C. Caldow (NOS/NCCOS)

- This report is the first time that an assessment of ecological performance has been conducted for MPAs in the USVI. The data presented here provide important baselines required for tracking MPA performance through future monitoring efforts.
- The degree of controversy for this work is moderate – the report shows that marine protected areas managed by National Park Service are not showing positive effects in rebuilding target species populations and coral reef health.

This document presents a comprehensive overview of results from more than a decade of work by the NOAA National Centers for Coastal Ocean Science (NCCOS) Biogeography Branch and the Department of the Interior National Park Service (NPS) to assess status and trends within and around federally managed marine protected areas (MPAs) of the U.S. Virgin Islands (USVI). The report provides: (1) an overview of the history of MPAs, types of MPAs and associated regulations, and a list of all MPAs in the USVI; (2) an ecological performance report for three intensively surveyed MPA units managed by NPS, including 20 biological metrics for fish and benthic habitat; (3) sightings of large-bodied fishes with moderate to high vulnerability to fishing; and (4) synthesis, summary and recommendations for management. This report is the first time that an assessment of ecological performance has been conducted for MPAs in the USVI. A decade of underwater surveys was analyzed to detect trends on coral reefs inside MPAs and for a similar range of habitats outside of MPAs. The information, data synthesis, interpretation and recommendations are intended to help focus management actions and goal setting, inform outreach products and adjust expectations regarding ecological performance for MPAs in the region. The data presented here provide important baselines required for tracking MPA performance through future monitoring efforts. Regardless of differences in fishing regulations, none of the assessed Federal MPAs in the USVI exhibited an increase in fish biomass, fish species richness, nor the abundance of herbivorous fishes on coral reefs inside their boundaries between 2002 and 2011. Adult parrotfish decreased in the Virgin Islands





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National Park and adult surgeonfish decreased inside Buck Island Reef National Monument. Adult groupers decreased in abundance inside the two no-take National Monuments (Buck Island Reef National Monument and Virgin Islands Coral Reef National Monument). The amount of live coral cover has decreased in all three MPAs and across the region, regardless of differences in regulations and human uses.

Publication date (online): October 2014

<http://www2.coastalscience.noaa.gov/publications/detail.aspx?resource=ZeQsddXPOr46G6cQSJ/7dpq5btwvL4fTOKV6BTCg/a8=>

NMFS

*Ecological causal assessment: Regional observational studies: assembling and exploring data;
Regional observational studies: deriving evidence*

CRC Press (BOOK)

P. Shaw-Allen(NMFS/OPR)

- The topic of the chapters is the assembly of observational data in preparation for deriving evidence and the process of deriving evidence.
- The chapters offer a strategy for identifying causes of ecological impairments and demonstrate statistical techniques to develop causal evidence.

Regional Observational Studies: Assembling and Exploring Data

The topic of this chapter is the assembly of observational data in preparation for deriving evidence. By regional observational data we mean measurements that are not associated with a direct manipulation of environmental conditions (e.g., measurements collected during monitoring), and that may or may not have been collected from a probability-based survey (e.g., Cochran, 1965). Observational data also include measurements collected by sensors on satellites or aircraft. Observational studies may include completed published reports and scientific papers describing insights derived from observational data, as well as un-interpreted





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observational data collected in databases. Information from published articles and reports are subject to the same scrutiny as applied to analyzing new data. Although the increase in the number of observations available in regional data sets provides an opportunity to conduct different and potentially more informative statistical analyses, an up-front warning on analysis of observational studies is in order: “In our experience, data preparation (assembly, cleanup, and quality control) is the single most time consuming part of using outside observational data. If the data are not already “yours,” it may consume half of your resources for analysis.”

Regional Observational Studies: Deriving Evidence

Observational studies provide evidence that the levels of a stressor observed in the case either are or are not capable of causing the observed effects. Evidence is generated by placing observations from the case in context with associations between stressors and effects observed at other places. We describe two general approaches: 1) stressor levels at the degraded site are compared with conditions at unimpaired sites or conditions at similarly degraded sites and 2) levels of stressors and effects observed in the case are compared with expectations based on stressor-response relationships developed from other places. Observational studies have the advantage of reflecting realistic exposure conditions, but analyses may be hampered by high natural variability and the influence of confounding factors. For the most part, regional reference sites and regional reference conditions will have been developed by the state or other agencies prior to assessment of impairment of the case itself. Because reference sites will have been identified for purposes other than causal assessment, the criteria for their selection should be reviewed before using them.

<http://www.crcpress.com/product/isbn/9781439870136>

